

MEMORANDUM FOR: All NWS Regional Headquarters, Regional Maintenance Specialists, Electronic Systems Analysts, and Electronics Technicians [Engineering Handbook (EHB)-9 distribution]

FROM: W/OPS1 - John McNulty

SUBJECT: Transmittal Memorandum for EHB-9 Issuance 01-08

1. Material Transmitted:

Engineering Handbook No. 9 (EHB-9), Automatic Radiotheodolite (ART)-1/2, Section 2.4, ART-1/2 Maintenance Note 21, ART-1/2 Routine Maintenance (for Electronics Technicians).

2. Summary:

ART-1/2 Routine Maintenance instructions for use with the Marconi 2024 signal generator.

3. Effect on Other Instructions:

These instructions supersede routine maintenance found in the ART-1/2 blue factory manuals. Make pen and ink changes to the Instruction Manual Number 9-601 (ART-1, 1R Maintenance) and 9-701 (ART-2, 2R Maintenance), Volume 1, paragraph 5.2. Enter the following notation: *"Refer to Maintenance Note 21 for ART-1/2 Routine Maintenance."*

ART-1/2 MAINTENANCE NOTE 21 (for Electronics Technicians)

Maintenance, Logistics, and Acquisition Division

W/OPS12: FJZ

SUBJECT : Automatic Radiotheodolite (ART-1/2) Routine Maintenance

PURPOSE : To provide ART-1/2 routine maintenance procedures

EQUIPMENT : All ART-1 and ART-2
AFFECTED

PARTS REQUIRED : None.

SPECIAL TOOLS REQUIRED	Type	<u>Manufacturer Model (or equivalent)</u>
	Signal Generator	Marconi 2024
	Multitester (VOM)	Triplett Model 60
	Digital Voltmeter (DVM)	Fluke 8050A
	Oscilloscope	Tektronics 465
	Frequency Counter	M1 Optoelectronics Handicounter
	Tuning Tools	Standard field assortment

MODIFICATION : None.
PROCUREMENT

SITES AFFECTED : All ART-1 and ART-2 sites

ESTIMATED TIME : N/A
REQUIRED

EFFECT ON OTHER : Make pen and ink changes to the Instruction Manual Number 9-601
INSTRUCTIONS (ART-1, 1R Maintenance) and 9-701 (ART-2, 2R Maintenance),
Volume 1, page 5-1, paragraph 5.2. Enter the following notation:
Refer Maintenance Note 21 for ART-1/2 routine maintenance.

AUTHORIZATION : N/A

VERIFICATION : This procedure was tested at several field stations (to be named prior
STATEMENT to submitting) and with the National Weather Service Training Center.

TECHNICAL : For questions or problems pertaining to this alignment, please contact
ASSISTANCE Franz J. G. Zichy at 301-713-1833, x128.

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GENERAL:

This maintenance note provides a revised ART-1/2 Routine Maintenance schedule and procedure for using the Marconi 2024 Signal Generator.

PROCEDURE:**1. Routine Maintenance**

This paragraph defines all periodic lubrication, test and alignment requirements necessary to maintain the ART-1, or ART-2 system. If the system fails any test requirement or can not be aligned properly, troubleshoot system in accordance with Instruction Manual Number 9-601 (ART-1, 1R Maintenance) and 9-701 (ART-2, 2R Maintenance), Volume 2, Chapter 6.

NOTE: Perform the Marconi Signal generator memory configurations as described in the attachment of this note.

1.1 Weekly Maintenance

Perform the following checks at the pedestal.

1.1.1 Service Meter Quick-Check

- a. With Test Selector switch in an unused position, observe SERVICE METER for a reading of 0. If necessary, adjust meter to 0 using adjusting screw on rear of meter.
- b. Position the R/ACU SYSTEM POWER switch to ON.
- c. Switch the R/ACU SERVICE METER switch through positions listed below and observe the SERVICE METER for the following indications:

<u>Switch Position</u>	<u>Normal Meter Indication</u>
115 Vac	+28 \pm 5 μ A (at 115 Vac input)
-28 Vdc	-26 \pm 5 μ A
-15 Vdc	-24 \pm 5 μ A
+15 Vdc	+24 \pm 5 μ A
+5 Vdc	+25 \pm 5 μ A
L.O.	+25 \pm 15 μ A

1.1.2 Azimuth Drive Current Idle Balance (A2R59 and A2R62)

- a. Verify the MANUAL TRACK MODE is illuminated and the STANDBY is extinguished.

- b. Position the test selector switch to AZ DRIVE. Alternately position the auxiliary test switch between UP/CW and DN/CCW while observing the SERVICE METER display. Normal system readings are (ART-1) $4.0 \pm 0.5 \mu\text{A}$, and (ART-2) $8.0 \pm 0.5 \mu\text{A}$ for both switch positions; if not, accomplish steps c (1) and (2).
- c. If the SERVICE METER reading is not as specified in step b, adjust balance resistor A1A2R62 and threshold resistor A1A2R59 as follows:

NOTE: Gain access to resistors by pulling the R/ACU drawer out until slide locks engage.

- (1) Locate the Azimuth/ Elevation Amplifier circuit card assembly A1A2.
- (2) Adjust the balance resistor R62 to equalize SERVICE METER readings for both auxiliary switch positions.
- (3) Adjust the threshold resistor R59 to obtain a reading on the SERVICE METER for both auxiliary switch positions.
- (4) Repeat the adjustment sequence until a normal reading is obtained on the SERVICE METER for both auxiliary switch positions.

NOTE: If after the alignment the pedestal creeps, adjust balance resistor R62 to eliminate creep. Verify by using the test 8 on the simulator and observe the digital display.

1.1.3 Elevation Drive Current Idle Balance (A2R23 and A2R26)

- a. Verify the MANUAL TRACK MODE is illuminated and STANDBY is extinguished.
- b. Position the test selector switch to EL DRIVE.
- c. Alternately, position the auxiliary test switch between UP/CW and DN/CCW while observing the SERVICE METER display. Normal system readings are (ART-1) $4.0 \pm 0.5 \mu\text{A}$, and (ART-2) $8.0 \pm 0.5 \mu\text{A}$ for both switch positions; if not, accomplish steps c (1) and (2).
- d. If the SERVICE METER reading is not as specified in step c, adjust balance resistor A1A2R26 and threshold resistor A1A2R23 as follows:

NOTE: Gain access to resistors by pulling the R/ACU drawer out until slide locks engage.

- (1) Locate the Azimuth/Elevation Amplifier circuit card assembly A1A2.
- (2) Adjust balance resistor R26 to equalize the SERVICE METER readings for both auxiliary switch positions.

- (3) Adjust threshold resistor R23 to obtain reading on SERVICE METER for both auxiliary switch positions.
- (4) Repeat the adjustment sequence until a normal reading is obtained on the SERVICE METER for both auxiliary switch positions.

NOTE: If after the alignment the pedestal creeps, adjust balance resistor R26 to eliminate creep. Verify by using test 8 on the simulator, and observe the digital display.

1.1.4 Target Antenna Test

Energize the target antenna.

1.1.4.1 Receiver Quick-Check

- a. From the MCU, move the antenna assembly to point at the target antenna.
- b. De-energize the target antenna.
- c. At the MCU press to illuminate FULL SEARCH mode switch. Observe that the FREQUENCY meter holds constant, and the SIGNAL LEVEL meter reads near 0.
- d. Press and release INITIATE pushbutton. Observe that the FREQUENCY meter slews from one extreme to the other and back, while the SIGNAL LEVEL meter remains near 0. AFC should not illuminate.
- e. Press and release LOW SENSITIVITY pushbutton a few times to observe that it illuminates and extinguishes on alternate switch operations. Leave LOW SENSITIVITY pushbutton extinguished.
- f. Press to illuminate LIMITED SEARCH pushbutton. Observe FREQUENCY meter holds constant for 3 seconds, then begins to slew over a limited portion of the dial for a nominal 12 seconds, and then begins to slew across the entire dial. During this time SIGNAL LEVEL meter should read near 0 and AFC indicator should not illuminate.
- g. Energize the target antenna.
- h. Observe the FREQUENCY meter approaching 1680 MHz, the sweep stops, and the SIGNAL LEVEL meter increases to the nominal reading (the reading usually observed from a specific target antenna installation). The AFC indicator illuminates shortly after the sweep stops.

1.1.4.2 Reset Check

- a. At the R/ACU, point antenna assembly at the target antenna and lock on the receiver in frequency and then lock on the tracking circuits in angle.

- b. Slew antenna assembly 3 to 4 degrees clockwise and press NEAR AUTO TRACK MODE pushbutton. Observe the antenna assembly response. It should be rapid with a small overshoot.
- c. Repeat step b in the counterclockwise, up, and down direction.
- d. Slew antenna assembly approximately 3 to 4 degrees clockwise and press FAR AUTO TRACK MODE pushbutton. Observe the antenna assembly reset response; it should be smooth and slow, taking about 15 to 20 seconds to stabilize.
- e. Repeat step d in the counterclockwise, up, and down directions.
- f. At the MCU, Repeat steps b through e, noting each final stabilized angle displayed on the Angle/Time display. Calculate the reset deadband error (the difference between the up and down, and the clockwise and counterclockwise displays). Reset deadband error must be less than 0.03 degrees. If error is excessive, perform tracking alignment; refer to Maintenance Note 20.
- g. De-energize the target antenna.

1.2 Monthly Maintenance

1.2.1 Battery Test

NOTE: Gain access to test point A7TP4 and BATTERY TEST switch A7S1 by pulling MCU out of cabinet to engage slide locks.

- a. Connect DVM between test point A7TP4 and ground.

NOTE: The following procedure may be accomplished with system power either off or on.

- b. Press BATTERY TEST switch A7S1; DVM should read 11 Vdc minimum. If not, battery is either discharged or defective. Charge battery for 12 hours and then repeat battery test. If battery fails test, replace battery.

1.2.2 System Checkout

- a. At the MCU set SYSTEM POWER ON/OFF switch to ON.
- b. Connect Signal Generator to:
 - ART-1: SIMULATOR IN (J1) connector on RF Assembly
 - ART-2: SIMULATOR IN connector on elevation housing

And Signal Generator EXTERNAL AM INPUT to SIMULATOR OUT connector on pedestal housing.

- c. At R/ACU, set POWER switch ON.
- d. Press [RCL] 118 [ENTER], to set the signal generator to 1680 MHz, @ 0.0 dBm.
- e. Set the R/ACU switches as follows:

<u>Switch</u>	<u>Setting or Indication</u>
MANUAL TRACK MODE	illuminated
MANUAL SEARCH MODE	illuminated
LOW SENSITIVITY	extinguished
AGC/MGC	extinguished
STANDBY	illuminated

- f. Using the FREQUENCY switch and observing the FREQUENCY METER on the R/ACU, manually tune the receiver to 1680 MHz. Then switch to LIMITED SEARCH MODE and observe that the receiver locks on to the signal generator (AFC indicator illuminates and frequency search halts at 1680 MHz).
- g. Set the R/ACU test selector switch to the following positions and observe the SERVICE METER for the listed normal indications:

NOTE: The AGC position may be checked at two levels of RF input.

<u>Switch Position</u>	<u>Normal Meter Indication</u>
115 Vac	+28 \pm 5 μ A (at 115 Vac input)
-28 Vdc	-26 \pm 5 μ A
-15 Vdc	-24 \pm 5 μ A
+15 Vdc	+24 \pm 5 μ A
+5 Vdc	+25 \pm 5 μ A
L.O.	+25 \pm 15 μ A
AFC	0 μ A \pm 5 μ A
AGC	+10 μ A \pm 5 μ A (0 dBm input) [RCL] 118 [ENTER], to set signal generator to 1680 MHz, @ 0.0 dBm +30 μ A \pm 10 μ A (-60 dBm input) [RCL] 100 [ENTER], to set signal generator to 1680 MHz, @ -60 dBm.

- h. Maintaining the previous setup, [RCL] 100 [ENTER], signal generator at 1680 MHz, @ -60 dBm.
- i. At the R/ACU, press MANUAL SEARCH MODE pushbutton and position the test selector switch to AFC position.
- j. Observe the SERVICE METER for a corresponding AFC indication of $\pm 25 \mu\text{A}$ minimum. Press the LIMITED SEARCH MODE pushbutton and observe that the receiver locks on to the signal generator's signal.
- k. Press [RCL] 115 [ENTER], to set signal generator to 1680 MHz, @ -50 dBm and alternately switch the signal generator to INTERNAL MODULATION at 200 Hz PRR and MODULATION OFF. Press [RCL] 119 [ENTER], and by pressing [MOD ON/OFF].
- l. Position the test selector switch in the following position and observe the SERVICE METER for the listed indications. Press [Mod ON/OFF] button to toggle Mod.

<u>Switch Position</u>	<u>Normal Meter Indication</u>
MET	5 μA or more (MOD ON)
	2 μA or less (MOD OFF)

Verify the presence of MET pulse audio from the speaker with a tone frequency proportional to Pulse Repetition Rate.

- m. Connect the SIMULATOR OUT connector on the pedestal to the EXTERNAL AM INPUT on the Signal Generator.
- n. Press [RCL] 116 [ENTER] to set Signal Generator to 1680 MHz @ -040 dBm.
- o. Press MENU 20 [ENTER], Select AM ext on the Marconi 2024.
- p. Position the R/ACU switches as follows:

<u>Switch</u>	<u>Setting or Indication</u>
MANUAL TRACK MODE	illuminated
MANUAL SEARCH MODE	illuminated
LOW SENSITIVITY	extinguished
AGC/MGC	extinguished
STANDBY	illuminated
OVERRIDE	illuminated

- q. Using the FREQUENCY switch and observing the FREQUENCY METER, manually tune the R/ACU to 1680 MHz. Then press LIMITED SEARCH MODE

pushbutton and verify that the receiver locks onto the signal generator (AFC illuminates and Frequency Search halts).

- r. Observe the approximate antenna azimuth angle on indicator assembly. Calculate an azimuth angle 90 degrees counterclockwise from that angle and then command that calculated angle for Simulator Test #3 as follows:

Position SIMULATOR switch ON
Press 3 and ENT
Press the 3 digits for the calculated angle
Press ENT

- s. Position test selector switch in AM position and observe the meter indication:

<u>Switch Position</u>	<u>Normal Indication</u>
AM	$0 \pm 3 \mu\text{A}$ for 0 % AM

Press EXC on the Simulator keyboard and observe that the meter reading increases to +20 or greater.

- t. Press CLR once on keyboard. Place test selector switch in TRK ERROR and observe the indication on the SERVICE METER:

<u>Switch Position</u>	<u>Normal Indication</u>
TRK ERROR	$0 \pm 3 \mu\text{A}$

Press EXC on the keyboard and observe that SERVICE METER reading increases to +20 μA or greater.

- u. Press CLR once on the keyboard. Place test selector switch in AZ ERROR position and observe the indication on the SERVICE METER:

<u>Switch Position</u>	<u>Normal Indication</u>
AZ ERROR	$0 \pm 3 \mu\text{A}$

- v. Press EXC and observe that the SERVICE METER reads at least -25 μA .

- w. Press CLR three times to clear the Simulator display. Position the antenna to approximately 30 degrees elevation. Then, command an elevation angle of 20 degrees as follows:

Press 3, ENT, DSP
Press 2, 0, ENT

- x. Verify that STANDBY and OVERRIDE pushbuttons are illuminated.

- y. Place the test selector switch in EL ERROR position and observe the indication on the SERVICE METER.

<u>Switch Position</u>	<u>Normal Indication</u>
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EL ERROR	$0 \pm 3 \mu\text{A}$
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- z. Press EXC and observe that the SERVICE METER reads at least $-25 \mu\text{A}$.
- aa. Press to extinguish STANDBY and OVERRIDE pushbuttons.

NOTE: The following procedure measures idle current and maximum drive current of the azimuth and elevation motors ART-1 and clutches ART-2. If any abnormal readings are observed, refer to Instruction Manuals Number 9-602, and 9-702, paragraph 6.3.5.1 for further fault isolation of the antenna drive circuits.

- bb. At R/ACU, position switches and controls as indicated and observe SERVICE METER for corresponding indication:

Service Meter Switch <u>Position</u>	Auxiliary Test Switch <u>Position</u>	Slew Rate <u>Control</u>	Azimuth Slew <u>Control</u>	Elevation Slew <u>Control</u>	Art-1 Service Meter <u>Indication</u>	Art-2 Service Meter <u>Indication</u>
AZ Drive	UP/CW	0	off	-	$4 \pm 1 \mu\text{A}$	$8 \pm 2 \mu\text{A}$
	DN/CCW	0	off	-	$4 \pm 1 \mu\text{A}$	$8 \pm 2 \mu\text{A}$
	UP/CW	maximum	CW	-	$30 \mu\text{A min}$	$20 \mu\text{A min}$
	DN/CCW	maximum	CCW	-	$30 \mu\text{A min}$	$20 \mu\text{A min}$
EL DRIVE	UP/CW	0	-	off	$4 \pm 1 \mu\text{A}$	$8 \pm 2 \mu\text{A}$
	DN/CCW	0	-	off	$4 \pm 1 \mu\text{A}$	$8 \pm 2 \mu\text{A}$
	UP/CW	maximum	-	UP	$30 \mu\text{A min}$	$20 \mu\text{A min}$
	DN/CCW	maximum	-	DN	$30 \mu\text{A min}$	$20 \mu\text{A min}$

1.2.3 Simulator Profile

- a. Set up system as follows:
 - (1) Verify the Signal Generator is connected to,
 - ART-1: SIMULATOR IN, J1 connector at the RF assembly
 - ART-2: SIMULATOR IN, auxiliary RF input connector on the elevation housing
 - SIMULATOR OUT connector at the pedestal assembly on both ART-1 and ART-2
 - (2) Press [RCL] 117 [ENTER], to set signal generator to:
 - 1680 MHz, @ -30 dBm
 - (3) Verify that MCU and R/ACU SYSTEM POWER switches are position ON.
 - (4) Position the R/ACU switches as follows:

<u>Switch</u>	<u>Setting or Indication</u>
MANUAL TRACK MODE	illuminated
LIMITED SEARCH MODE	illuminated
SIMULATOR/OFF	OFF and then to SIMULATOR
LOW SENSITIVITY	extinguished
STANDBY	extinguished
SIGNAL LEVEL/FREQ	SIGNAL LEVEL

- (5) Observe the AFC indicator on R/ACU is illuminated when the receiver is locked to Signal Generator frequency. Check that the receiver is not locked onto a false signal by observing the SIGNAL LEVEL/FREQ METER. The Meter should indicate 20 dB (minimum).
- b. Press CLR button on SIMULATOR keyboard three times.
- c. Press in sequence the following buttons on SIMULATOR keyboard: 6, ENT, EXC.
- d. Observe R/ACU SIMULATOR upper display. It should indicate PFILE (PROFILE mode); the SIMULATOR FUNCTION display should indicate P and the SIMULATOR TEST display should indicate 6. Press to illuminate NEAR AUTO TRACK MODE pushbutton. The Antenna should begin to move to the initial angles (AZ = 179.88 EL = 2.40). Wait until antenna stops at the initial angles before proceeding to next step.
- e. At the MCU, position the PRINT RATE switch to 1.
- f. At the Printer (LX:80), position POWER switch to ON.
- g. At the MCU or RCU, momentarily press the MANUAL RELEASE pushbutton.
- h. After the printer has operated for 40 minutes, press the STOP PRINT pushbutton on the MCU and the SIMULATOR CLR button on the R/ACU keyboard.
- i. Compare data for minutes 10 through 40 of the printout with the run test ET.
- j. Disconnect the signal generator from the RF Assembly.

1.3 Quarterly Maintenance

1.3.1 Power Supply Alignment

This procedure is intended for field alignment or test of the power supplies contained in each of the major units and identified as follows:

<u>R/ACU:</u>	1A3A1PS1	-28V
	1A3A1PS2	-15V
	1A3A1PS3	+15V
	1A3A1PS4	+5V
<u>RCU:</u>	5A1PS1	+15V / +5V
<u>MCU:</u>	3A3PS1	+15 V / + 5V
	3A3A1A7	-12 V / + 14V
	3A3BT1	Battery

1.3.1.1 Battery Test

NOTE: Gain access to test point A7TP4 and BATTERY TEST switch A7S1 by pulling MCU out of cabinet to engage slide locks.

- a. Connect DVM between test point A7TP4 and ground.

NOTE: The following procedure may be accomplished with system power either off or on.

- b. Press the BATTERY TEST switch A7S1; DVM should read 11 Vdc minimum. If not, the battery is either discharged or defective. Charge the battery for 12 hours, then repeat the battery test. If the battery fails test, replace the battery.

1.3.1.2 Power Supply Alignment Procedure

The power supply alignment chart, below, gives all alignment parameters. A description of the columns follows:

- a. Column 1 lists the location and the reference designation suffix of each power supply, voltage regulator, etc.
- b. Column 2 lists the output voltage measurement test point. Connect the positive lead of the DVM to this test point and the negative lead to chassis ground.
- c. Column 3 lists the adjusting control used to set the output voltage.
- d. Column 4 lists the desired adjusted output as measured on the DVM.

Power Supply Alignment Chart

<u>Power Supply</u>	<u>Test Point</u>	<u>Adjust</u>	<u>Voltage</u>	
R/ACU	PS1	TP6	R2	-28.0 ± 0.1 V
	PS2	TP3	R12	-15.00 ± 0.01 V
	PS3	TP2	R12	+15.00 ± 0.01 V
	PS4	TP2	R12	+5.0 ± 0.1 V
RCU	PS1	Term. 9	R10	+15.0 ± 0.1 V
	PS1	Term. 7	R21	+5.0 ± 0.1 V
MCU	PS1	TP2	R12	+5.0 ± 0.1 V
	A1A7	TP8	R21	-12.0 ± 0.1 V
	A1A7	TP4	R3	*

* Voltage measurements at TP4 must be compensated for temperatures and accomplished per step e.

e. Adjust the voltage regulator circuit card assembly for output at TP4 as follows:

- (1) Disconnect the negative terminal on the battery.
- (2) Adjust R3 for $+14.1 \pm 0.1 \text{ V}$ at TP4 (at $+25^\circ\text{C}$). For other conditions of ambient temperature, the voltage is adjusted for the value listed below using interpolation for intermediate temperature:

<u>Temp</u>	<u>°C</u>	<u>°F</u>	<u>Voltage</u>
	0	32	14.7
	10	50	14.5
	20	68	14.2
	30	86	14.0
	40	104	13.8
	50	122	13.6

- (3) Once adjusted, the output voltage will properly track over a changing temperature range.
- (4) Reconnect the negative terminal on the battery.

1.4 Semiannual Maintenance

1.4.1 Clean and Lubricate Pedestal on ART-1

1.4.1.1 Clean Filters

a. Cleaning Rear Housing Air Cleaner:

- (1) Remove cover assembly, and air cleaner from housing assembly.

- (2) Immerse air cleaner element in an oil emulsifier, then dry it using shop air.
- (3) Wash air cleaner with hot soapy water, then dry it using shop air.
- (4) Apply oil to the air cleaner element.
- (5) Secure air cleaner element and cover assembly to housing assembly.
- b. Cleaning Fabric Wire Assemblies 1A3A326 through 1A3A333:
 - (1) Remove Receiver/Antenna Control Unit (R/ACU) from pedestal assembly; refer to Instruction Manual Number 9-601, paragraph 5.3.11.

NOTE: Fabric wire assemblies may be cleaned in place if compressed air is available. If so, perform step below. If not, proceed to step (3).

- (2) Clean eight fabric wire assemblies (air cleaners) using blasts of compressed air to remove dust and dirt.

NOTE: Cleaning procedure for each of the eight fabric wire assemblies is identical. The procedure in step 3 through 6 below is a typical cleaning procedure for all eight air cleaners. Refer to Instruction Manual Number 9-601, paragraph 7.3 for reference designation of attaching hardware.

- (3) Remove cover from housing. Then remove air cleaner from housing.
- (4) Wash air cleaner with hot soapy water and dry thoroughly.
- (5) Secure air cleaner to housing.
- (6) Secure cover housing.
- (7) Install R/ACU in pedestal assembly.

1.4.1.2 Lubrication ART-1

- a. Gain access to components as follows:
 - (1) Remove cover from elevation assembly, then remove strap assembly and cover with gasket from elevation assembly.
 - (2) Remove cover assembly from azimuth unit.
 - (3) Remove cover assembly with gasket from azimuth unit.
- b. Perform pedestal assembly inspection by visually inspecting interior of elevation assembly and azimuth unit for worn and loose gears.
- c. Using a listless cloth, lightly dampened in dry-cleaning solvent, clean exposed surfaces of components to be lubricated. Then, using low temperature lubricating grease MIL-G-23827 and special oil VV-L-800 lubricate pedestal assembly components in accordance with the following:

NOTE: Allow cleaning fluid to come in contact with only the components to be lubricated.

<u>Component</u>	<u>Lubricant</u>	<u>Special Instructions</u>
Turnbuckle mounting screws	grease	Coat lightly
Tripod leg assembly mounting screws	grease	Coat lightly
Stow lock shafts (elevation and azimuth)	oil	Apply liberally, rotate shaft to spread oil
Angle indicator cover hinges (elevation and azimuth)	oil	Apply liberally
Indicator drive bearing (elevation and azimuth)	oil	Apply a few drops
Azimuth unit cover assembly captive screws	oil	Apply 2 to 3 drops
Indicator Assembly gears (elevation and azimuth)	grease	Apply sparingly to gear teeth
Drive motor (elevation and azimuth)	grease	Remove two grease plugs; apply grease sparingly. Then reinstall grease plugs
Leg adjusting screws	grease	Coat lightly
Turntable upper bearing	grease	Apply sparingly with manually operated grease gun
Turntable lower bearing	grease	Apply sparingly with manually operated grease gun
Azimuth drive gears	grease	Apply sparingly to gear teeth
Trunnion bearings (2 places)	grease	Apply sparingly with manually operated grease gun
Elevation assembly gear segment	grease	Apply sparingly to gear teeth
Elevation drive gears	grease	Apply sparingly to gear teeth
Counterbalance spring gears	grease	Apply sparingly to gear teeth

d. Close access to components as follows:

- (1) Secure cover with gasket and strap assembly to elevation assembly.
- (2) Secure cover assembly to azimuth unit.
- (3) Secure cover to azimuth unit.

1.4.2 Lubrication of Pedestal Housing (1A3) and Elevation Housing (1A2) ART-2

- a. Loosen twelve captive screws and remove the transmitter/comparator (1A3A3) from the pedestal housing (1A3).
- b. Apply Aeroshell 6/7 grease to azimuth ring gear 1A3MP4006.

- c. Replace the transmitter/comparator (1A3A3) and the pedestal housing (1A3). Then tighten twelve captive screws.
- d. Apply Aeroshell 6/7 grease to elevation sector gear 1A2MP4005.

1.4.3 Synchro Alignment

This procedure is intended for field alignment of the Azimuth and Elevation synchro transmitters to ensure accurate tracking angle data. This procedure must be accomplished whenever a synchro transmitter or a complete drive assembly has been replaced. Two alternate alignment procedures are provided. One uses the TEST 8 feature of the built-in-test simulator in the R/ACU. An alternate version is included that does not use the simulator.

CAUTION

Correct alignment of the azimuth and elevation indicator assemblies, receiver circuits, and tracking circuits are prerequisite to the proper performance of this procedure.

*****WARNING*****

The following steps require exposure to 115 Vac. Avoid contact with bare wires and terminals.

1.4.3.1 Synchro Alignment Setup

- a. Energize the target antenna.
- b. At R/ACU press to illuminate LIMITED SEARCH MODE and NEAR AUTO TRACK MODE, Observe normal frequency lock-on (AFC indicator should illuminate and SIGNAL LEVEL/FREQ METER should stop search). Observe the antenna assembly slews and locks on the target antenna.
- c. Adjust the mechanical azimuth and elevation indicator dials to match the surveyed target antenna angles, as closely as possible.

1.4.3.2 Azimuth Synchro Alignment

- a. Azimuth 1X Synchro (1A3A3B703 ART-1) / (1A3A2B2402 ART-2)

- (1) At the R/ACU, press to illuminate MANUAL TRACK MODE.
- (2) Slew the antenna assembly until the azimuth angle is at zero degrees by observing one of the following:
 - (a) The mechanical azimuth indicator (set to the target antenna angles earlier) reads 000.00. (Due to the coarse indication, this technique is not recommended for ART-2.
 - (b) The Azimuth Display at the DCA has been changed by the angle between the target antenna survey and 0 degrees (for example, if the target antenna is at 320 degrees slew clockwise by 40 degrees on the DCA Azimuth readout).
 - (c) At the R/ACU, use the Built In Test Simulator Test 8 to display Azimuth Angle. Place SIMULATOR switch to ON. On Simulator keypad, press in sequence the following keys: 8, ENT, EXC. Observe the simulator display shows an 8 under TEST, an A under FUNCTION, and the Azimuth Angle. Slew antenna until the displayed angle has been changed by the angle between the target antenna survey and 0. (Example: if the target antenna is at 50.37 degrees, slew counterclockwise 50.37 degrees regardless of starting reading).
- (3) Position R/ACU system POWER switch OFF.
- (4) Loosen the three screws which secure synchro (B703 ART-1) and (1A3A2B2402 ART-2).
- (5) Connect VOM to terminals:
ART-1: 1A3A3E706-6 and 1A3A3E704-29
ART-2: 1A3A2E4003-16 and 1A3A2E4003-4
- (6) At R/ACU position system POWER switch ON.
- (7) Rotate 1X synchro transmitter until a voltage of 40 Vac is obtained on the VOM.
- (8) Position R/ACU system POWER switch OFF.
- (9) Connect VOM to terminals,
ART-1: 1A3A3E706-1 and 1A3A3E704-27
ART-2: 1A3A2E4003-17 and 1A3A2E4003-15
- (10) Position R/ACU system POWER switch ON.
- (11) Rotate the 1X synchro transmitter until a minimum voltage is obtained on the VOM.
- (12) Verify 40 ± 30 Vac between:
ART-1: 1A3A3E706-6 and 1A3A3E704-29
ART-2: 1A3A2E4003-16 and 1A3A2E4003-4
If not, rotate synchro 180 degrees and repeat steps (7) through (11).
- (13) Connect VOM to:
ART-1: 1A3A3E706-1 and 1A3A3E704-27

Carefully tighten the three screws which secure the 1X synchro transmitter while maintaining a reading of less than 0.5 Vac on VOM.

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- (b) With the help of an assistant at the DCA, note the Azimuth angle on the Angle/Time Display.
- (2) The indicated Azimuth angle should match the target antenna surveyed angle to within ± 0.3 degrees. If not, skip to step (5).
 - (3) If necessary, rotate the 180X synchro transmitter until the Azimuth digital display (either Simulator Display or DCA Azimuth Display) reads within 0.01 degrees of the target antenna's surveyed angle.
 - (4) Carefully tighten the screws which secure the 180X synchro transmitter while maintaining the target antenna's surveyed angle, as read on the AZIMUTH display at the Angle/Time Display or Simulator. This completes the Azimuth synchro alignment. Proceed to paragraph 1.4.3.3.
 - (5) If the indicated angle in step (2) above does not match the desired angle, the synchros are now in phase, but incorrect. Note the displayed Azimuth angle, then slew the antenna until the displayed angle has been changed by the angle between the target antenna and zero degrees.
 Example 1: Target Antenna: 330.70
 Azimuth display: 337.20
 Move antenna by $(360 - 330.7) = +29.3^\circ$
 Move antenna until display reads $(337.20 + 29.3) = 6.5^\circ$

 Example 2: Target Antenna: 89.37
 Azimuth Display: 86.21
 Move antenna by $89.37 - 0 = 89.37$
 Move antenna by $86.21 - 89.37 = 3.16 = 356.84^\circ$
 - (6) When the antenna is at true zero degrees (referred to the target antenna), repeat Azimuth Synchro Alignment, paragraph 1.4.3.2, a. (3) through c. (4).

1.4.3.3 Elevation Synchro Alignment

- a. Elevation 1X synchro (1A3A2B203 ART-1) / (1A2A2B2402 ART-2)
 - (1) At the R/ACU, press to illuminate MANUAL TRACK mode.
 - (2) Slew the antenna assembly until the Elevation angle is at zero degrees by observing on of the following:
 - (a) The mechanical Elevation indicator (set to the target antenna angles in 1.4.3.1) reads 00.00. (Due to the coarse indication, this step is not recommended for ART-2.)
 - (b) The Elevation Display at the DCA has been changed by the angle between the target survey and 0° (for example, if the target antenna is at 10.40 degrees, slew down by 10.40 degrees on the DCA Elevation display).

- (c) Use the Built In Test Simulator Test 8 to display Elevation Angle. Place SIMULATOR switch to ON. On simulator keypad, press in sequence 8, ENT, EXC, DSP, Observe that simulator display shows an 8 under TEST, an E under FUNCTION and the Elevation angle. Slew antenna until the displayed angle has been changed by the angle between the target antenna survey and 0.
 - (d) If the above steps are not usable, use a plumb bob to align the reflector perimeter vertically.
- (3) Position R/ACU system POWER switch OFF.
- (4) Loosen the three screws which secure the 1X synchro transmitter.
- (5) Connect VOM to terminals:
 - ART-1: 1A3A2A1E201-9 and 1A3A2A1E201-31
 - ART-2: 1A2A2E2502-15 and 1A2A2E2502-4
- (6) Position R/ACU system POWER switch ON.
- (7) Rotate the 1X synchro transmitter until a voltage of 40 Vac is obtained on the VOM.
- (8) Position R/ACU system POWER switch OFF.
- (9) Connect VOM to terminals:
 - ART-1: 1A3A2A1E201-19 and 1A3A2A1E201-30
 - ART-2: 1A2A2E2502-16 and 1A2A2E2502-17
- (10) Position R/ACU system POWER switch ON.
- (11) Rotate the 1X synchro transmitter until a minimum voltage is obtained on the VOM.
- (12) Verify 40 ± 30 Vac between:
 - ART-1: 1A3A2A1E201-9 and 1A3A2A1E201-31
 - ART-2: 1A2A2E2502-15 and 1A2A2E2502-4

If not, rotate synchro 180° and repeat steps (7) through (11).
- (13) Reconnect VOM between:
 - ART-1: 1A3A2A1E201-19 and 1A3A2A1E201-30
 - ART-2: 1A2A2E2502-16 and 1A2A2E2502-17

Carefully tighten the three screws which secure the 1X synchro transmitter while maintaining a reading of less than 0.5 Vac on VOM.
- (14) Position R/ACU system POWER switch OFF.
- b. Elevation 180X synchro (1A3A2A1B202 ART-1) / (1A2A2B2402 ART-2)
 - (1) With the antenna still at 00.00° elevation and the R/ACU system POWER switch OFF, connect the VOM to terminals:
 - ART-1: 1A3A2A1E201-1 and 1A3A2A1E201-31
 - ART-2: 1A2A2E2502-4 and 1A2A2E2502-18
 - (2) Loosen the three screws which secure 180X synchro transmitter.

- (3) Position R/ACU system POWER switch ON.
- (4) Rotate the 180X synchro transmitter until a voltage of 40 Vac is obtained on the VOM.
- (5) Position R/ACU system POWER switch OFF.
- (6) Connect VOM to terminals:
ART-1: 1A3A2A1E201-11 and 1A3A2A1E201-30
ART-2: 1A2A2E2502-19 and 1A2A2E2502-20
- (7) Position R/ACU system POWER switch ON.
- (8) Rotate the 180X synchro transmitter until a minimum voltage is obtained: Temporarily secure it by tightening three screws.
- (9) Verify 40 ± 30 Vac between:
ART-1: 1A3A2A1E201-1 and 1A3A2A1E201-31
ART-2: 1A2A2E2502-4 and 1A2A2E2502-18
If not, rotate synchro 180° and repeat steps (4) through (8).
- (10) Slew antenna assembly to the surveyed angles of the target antenna.
- (11) At R/ACU, press to illuminate LIMITED SEARCH MODE and NEAR AUTO TRACK MODE pushbuttons. Observe normal frequency lock-on (AFC indicator should illuminate and SIGNAL LEVEL/FREQ METER should stop searching). Observe that antenna assembly slews to and locks on the target antenna.

c. Elevation Display Check

- (1) Observe the digital displayed angle by either of the following methods:
 - (a) At R/ACU, place SIMULATOR switch ON. On Simulator keypad, press in sequence the following keys: 8, ENT, DSP, EXC. Observe that simulator display shows an 8 under TEST, an E under Function, and the Elevation Angle.
 - (b) With the help of an assistant at the MCU, note the Elevation angle of the Angle/Time Display.
- (2) The indicated Elevation angle should match the target antenna surveyed angle to within ± 0.3 degrees. If not, skip to step (5).
- (3) If necessary, rotate the 180X synchro transmitter until the Elevation digital display (either DCA or Simulator) reads within 0.01 degree of the target antenna's surveyed angle.
- (4) Carefully tighten the screws which secure the 180X synchro transmitter while maintaining the target antenna's surveyed angle, read on the ELEVATION display of the Angle/Time display. This completes the Elevation Synchro Alignment.
- (5) If the indicated angle in step (2) above does not match the desired angle, the synchros are now in phase, but incorrect. Note the displayed elevation angle, then slew the antenna until the displayed angle has been changed by the angle between the target antenna and zero degrees. To

do this, Subtract the surveyed elevation angle from the observed and slew down until the digital readout reads the difference (example: survey 12.71° and observed 13.61°: slew to 0.9°).

- (6) With the antenna at true zero elevation, (referenced to the target antenna) repeat the Elevation Synchro Alignment, paragraph 1.4.3.3, a (3) through c (4).

1.4.4 Data Control Circuits

This procedure is intended for field alignment of the RCU Release Tone.

1.4.4.1 RCU Release Tone Adjustment

The release timing tones audio volume is adjusted by an internal control and is independent of the front panel MET data audio volume control. The adjustment of the internal audio volume control ensures release sequence audibility regardless of the front panel MET data audio volume setting. Perform this adjustment as necessary.

- a. Depress REMOTE RELEASE on the RCU front panel, and verify a normal sequence of "ticks" and warning tones from the speaker.
- b. Adjust A3R18 to obtain a satisfactory sound level at the launch area.
- c. Repeat the sequence as necessary to achieve a suitable level.

This concludes the Routine Maintenance procedures.

REPORT MAINTENANCE

Report maintenance on a WS Form A-26, Maintenance Record, according to instructions in Engineering Handbook No. 4 (EHB-4), Part 2, and Appendix J. A sample WS Form A-26 is attached. As an additional guide, refer to the table below:

Block #	Block Type	Information
5	Description	Describe the required routine maintenance checks on ART system
7	Equipment Code	ART1 or ART2 (as appropriate)
9	Type Maintenance (TM)	Use applicable numerical TM code I.A.W. EGB -4
10	Action Taken (AT)	Use applicable AT code I.A.W. EHB-4
15	Comments	Enter comments that fully describe maintenance event






















John McNulty
Chief, Maintenance, Logistics, and Acquisition Division


















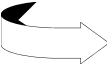
















Attachment A - Marconi 2024 Memory Settings
Attachment B - WS Form A-26 Sample



































ATTACHMENT A

Marconi 2024 Memory Settings

Perform the following signal generator parameter memory stores. The ART alignment refers to these memory settings to facilitate the signal generator setup for the receiver and tracking alignments, and Routine Maintenance. Reading the table from left to right, follow the instructions given below. Reference the Marconi Operating Manual for complete operating instructions.

Saving Power Up Settings						
To reset generator to factory settings 2		999				
Set to 1680 MHz 2		1680				
Enable internal pulse modulation 2		22		2		
Set to -60 dBm 2		-60				
Set to AM external 2		20		 or 	AM ext	
Set modulation source and AM depth of modulation 2		30		 or 	Ext:	2
			ON	30		

Store settings 2		100				
Storing power up settings 2		54		 or 	Power Up Choice	1
		Recall memory	100			
Storing AGC Alignment Settings						
Store 1655 MHz 2		1655			101	
Store 1670 MHz 2		1670			102	
		0				
Store 1690 MHz 2		1690			1	
Recall 1680 MHz 2		100				
Store -74 dBm 2		-74			103	
Store -5 dBm 2		-5			104	

Store -100 dBm 2		-100			105	
Store -80 dBm 2		-80			106	
Store -104 dBm 2		-104			107	
Store -4 dBm 2		-4			108	
Storing AFC Alignment Settings						
Store 10.7 MHz at 6.2 dBm for a 1.6 - 1.8 V p-p output level 2		10.7			6.2	
		109				
Store 10.45 MHz 2		10.45			110	
		2				
Store 10.95 MHz 2		10.95			3	

Storing MET Data Digitizer Settings

Store 1680 MHz at
-60 dBm, INT Pulse
Mod ON at 100 Hz

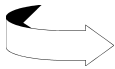
2



100



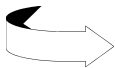
**Pulse
Mod INT
OFF**



**Pulse
Mod INT
ON**



100



111



Video Amplifier Alignment (A14R36 and A5R10)

Store -30dBm

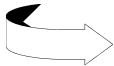
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103































-30



112



Routine Maintenance						
Store -50 dBm 2		-50			115	
Store -40 dBm 2		-40			116	
Store -30 dBm 2		-30			117	
Store 0.0 dBm 2		0			118	
Store 1680 MHz at -50 dBm, INT Pulse Mod ON at 200 Hz 2		115				
	Pulse Mod INT OFF		Pulse Mod INT ON		200	
		119				

ATTACHMENT B

WS FORM A-26 (4/94)		WS FORM A-26 (4/94)				U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NATIONAL WEATHER SERVICE				Document Number G 49978			
ENGINEERING MANAGEMENT REPORTING SYSTEM MAINTENANCE RECORD													
General Information		1. Open Date 10 / 25 / 01		Time 0900		2. Initials JMM		3. Response Priority (check one) <input type="radio"/> Immediate <input type="radio"/> Low <input checked="" type="radio"/> Routine <input type="radio"/> Not Applicable		4. Close Date 10 / 25 / 01		Time 1200	
5. Description Performed routine maintenance check on ART system													
Equipment Information		6. Station ID AMA		7. Equipment Code ART1		8. Serial Number 019		9. TM 2		10. AT X		11. How Mal. 999	
12. EQUIPMENT OPERATIONAL STATUS TIMES		a. Fully Operational <input type="text"/>		b. Logistics Delay <input type="text"/>		Partly Operational		c. All Other <input type="text"/>		d. Logistics Delay <input type="text"/>		Not Operational <input type="text"/>	
												3:00	
13. Parts Failure Information										14. Work Load Information			
Block #	a. ASN	b. NSN	c. TM	d. AT	e. How Mal.	f. Qty.	g. Maint. Hrs.	Type	Staff Hrs.				
1								a. Routine	3:00				
2								b. Non-routine					
3								c. Travel					
4								d. Misc.					
5								e. Overtime					
Miscellaneous Information		15. Maintenance Comments Weekly maintenance: Service Meter check, Azimuth and Elevation Drive Current checks, Target Antenna test, Reset Check										16. Initials JMM	
17. SPECIAL PURPOSE REPORTING		a. Mod. No.		b. Mod./Act./Deact. Date		c.		d.		e.			
18. CONFIGURATION MGMT. REPORTING (use as directed)		ASN		Vendor Part Number (New Part)		Serial Number (Old Part)		Serial Number (New Part)					